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Options for facilitating the development, transfer and dissemination of clean and environmentally sound technologies

Report of the Secretary-General

Summary

The present report, prepared pursuant to General Assembly resolution 67/203, complements the analysis, findings and recommendations contained in the report of the Secretary-General on options for a technology facilitation mechanism (A/67/348). It proposes additional background information and details on options for the way forward to facilitate the development, transfer and dissemination of clean and environmentally sound technologies. In particular, it reports on the deliberations at the workshops on the development, transfer and dissemination of clean and environmentally sound technologies in developing countries that were convened by the President of the Assembly in April and May 2013, as well as on recent written inputs received from Member States and the United Nations system.

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I. Introduction

1. The present report has been prepared pursuant to General Assembly resolution 67/203, in which the Assembly decided to hold four workshops on the development, transfer and dissemination of clean and environmentally sound technologies and the connection between clean and environmentally sound technologies and sustainable development. It also decided that the workshops would discuss, inter alia, the technology needs of developing countries, options to address those needs, capacity-building and options for a technology facilitation mechanism, taking into account existing mechanisms. The Secretary-General was requested to present a report on the discussions, options and recommendations from the workshops, including on the way forward, as well as on additional inputs from Member States and the United Nations system.

2. The need to facilitate the dissemination of clean and environmentally sound technologies has been recognized by Member States since at least 1972, when the United Nations Conference on the Human Environment, held in Stockholm, asserted that environmental technologies should be made available to developing countries on terms which would encourage their wide dissemination (principle 20). Agenda 21 and the Plan of Implementation of the World Summit on Sustainable Development included more detailed commitments on science and technology geared to facilitate technology access, transfer and dissemination.

3. More recently, the outcome document of the United Nations Conference on Sustainable Development, held in Rio de Janeiro, Brazil, in June 2012, contained a section dedicated to technology (paras. 269-276). Paragraph 269 reiterated the call to promote, facilitate and finance, as appropriate, access to and the development, transfer and diffusion of environmentally sound technologies and corresponding know-how, in particular to developing countries, on favourable terms, including on concessional and preferential terms, as mutually agreed. Pursuant to paragraph 273 of the outcome document, the Secretary-General presented a report on options for a facilitation mechanism that promotes the development, transfer and dissemination of clean and environmentally sound technologies (A/67/348).

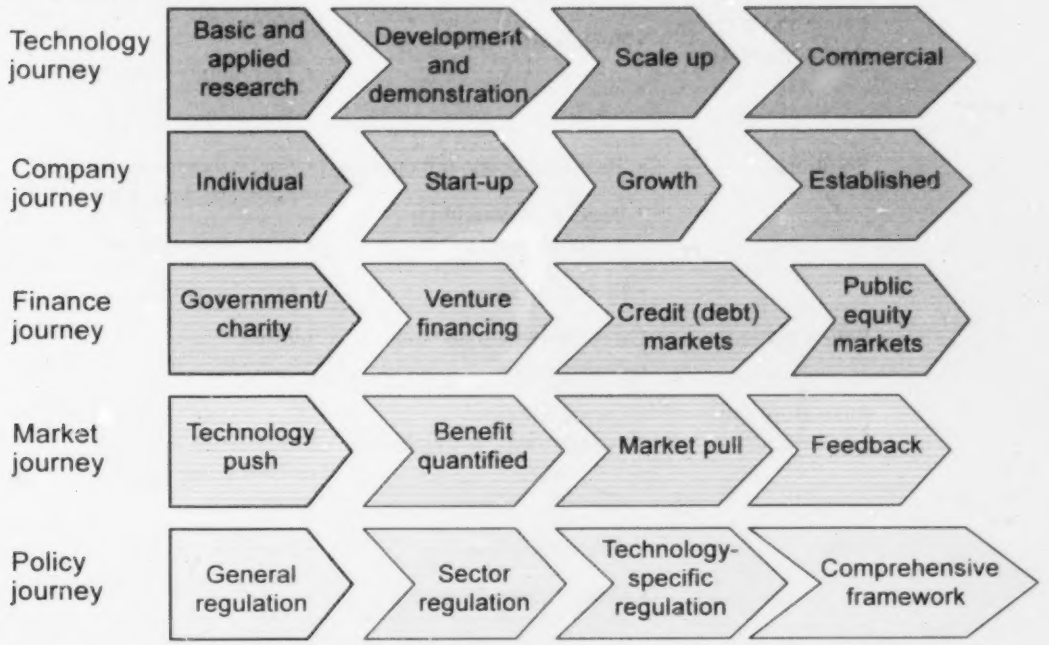
4. The report provided a synthesis of proposals received from the United Nations system for a technology facilitation mechanism and outlined recommendations for the functions, format and working methods of such a mechanism, as well as the potential way forward. It also considered proposals received by Governments and major groups in the preparatory process for the United Nations Conference on Sustainable Development. The report highlighted the challenges in addressing constraints in each stage of the technology cycle, from research, development and demonstration to diffusion in the marketplace, and emphasized the need for institutional solutions to bridge the gaps between technology stages.

5. The workshops held earlier in 2013 provided an opportunity for in-depth discussions. They validated the analysis contained in the report and emphasized the view that a comprehensive approach is needed for technology facilitation, as the challenge is broader than that of cross-border technology transfer and goes well beyond a narrowly defined technology agenda. Coordinated action by a wide range of actors is essential to rapid technology diffusion. Figure I below illustrates one such view presented at the workshops, that translating research into application

requires progress along the full technology cycle in terms of technology, business, finance, markets and policy.

Figure I

Beyond research and development: translating research into application requires progress on multiple journeys



Source: Ambuj Sagar and Bloomberg New Energy Finance, *Climate Innovation Centres: A New Way to Foster Climate Technologies in the Developing World* (2010).

6. The report of the Secretary-General provided a broad review of global trends in science and technology for sustainable development. The workshops provided further examples highlighting the increasing importance of factors and channels outside the traditional domain of science and technology policy and of official development assistance frameworks, such as trade, foreign direct investment and industrial policy, all of which have an impact on the ability of developing countries to acquire and deploy technologies. One of the perspectives presented at the workshops is summarized in table 1 below.

7. Section II of the present report reviews the understanding of and debate on technology facilitation as it arose from the workshops, while section III presents a set of actionable recommendations for the way forward on this issue in the United Nations.

Table 1
International technology collaboration and low-carbon innovation: conventional and emerging perspectives

Key themes	*Conventional notions*	*Emerging perspectives*
Movement of goods and services (technologies)	• North to South • Technology transfer • One way	• South to South, South to North • Technology cooperation • Two or more ways
Solutions	• Technical/economic options • Bias for overarching prescriptions • Piecemeal	• Social dynamics just as, if not more, important • Context matters • More systematic
Policy measures	Direct; international and national levels	Indirect
Innovators and innovation	Experts; frontier, "breakthrough" technologies	"Lay people" and experts; incremental, adaptive technologies; frugal innovation
Actors	• Donor/recipient • Often "lumped together"	• Partners; engaged throughout in a meaningful way • Heterogeneous
Channels	• Within firms is dominant (from headquarters to subsidiary) • Between firms — joint ventures and licensing (North to South) • Some triple helix[a]	• Within firms (subsidiary to headquarters) • Acquisition or majority ownership of Northern firms by Southern firms • While rare, some instances of quadruple helix[a]

Source: Presentation by Alexandra Mallett (Carleton University) at the workshops, 31 May 2013.

[a] The triple helix thesis states that the potential for innovation and economic development in a knowledge society lies in a more prominent role for the university and the hybridization of elements from university, industry and Government to generate new institutional and social formats for the production, transfer and application of knowledge. See Stanford University, Triple Helix Research Group, "The triple helix concept" (http://triplehelix.stanford.edu/3helix_concept). The quadruple helix adds civil society.

II. Range of views on key questions

A. Technology needs and options to address them

8. The present section presents a panorama of the range of views expressed and the evidence presented at the workshops and in written contributions submitted by Member States and United Nations entities.[1] The big question of what developing countries need in the area of clean and environmentally sound technology facilitation is broken down into smaller specific questions and issues around which the major debates tend to concentrate. In order to resolve the problem at hand, responses to these issues that could provide a convergence of views will be needed.

i. How big is the technology gap that developing countries are facing?

9. Data for assessing the magnitude and nature of the technology gap that developing countries are facing are limited and fragmented. This is particularly the case for smaller developing economies and the least developed countries. Indeed, most empirical evidence focuses on emerging economies, particularly India and China. There is a need for more comprehensive information on the needs of technology recipients in developing countries.[2]

10. Against this background, it is not surprising that views differ greatly on the technology gap in developing countries. Some talk about an emerging multipolar world of innovation,[3] whereas others continue to point out that the overwhelming share of innovation effort globally continues to be undertaken in developed countries. Yet others underline that the growth in developing country activity on clean and environmentally sound technologies observed in recent years is entirely concentrated in a few large developing countries and that the least developed countries continue to be severely disadvantaged, not being in a position to "leapfrog". There is scarce evidence on the magnitude of needs in the majority of developing countries that are neither least developed countries nor large developing countries.

11. An often-used rough proxy for innovation effort in a country is the ratio of total research and development expenditure against gross domestic product (GDP) (see fig. II below). It should also be noted that not every effort to generate new technologies is relevant for sustainable development. Yet, today's understanding of sustainable development is broad enough to encompass nearly every production sector and policy area.

12. It is often underlined that innovation effort measured in this way represents an even lower share of a lower GDP per capita income in developing countries

[1] An exhaustive account of the workshops is available from http://sustainabledevelopment.un.org/technology/2013workshops.

[2] Presentation by Ahmed Abdel Latif, International Centre for Trade and Sustainable Development, at the workshops.

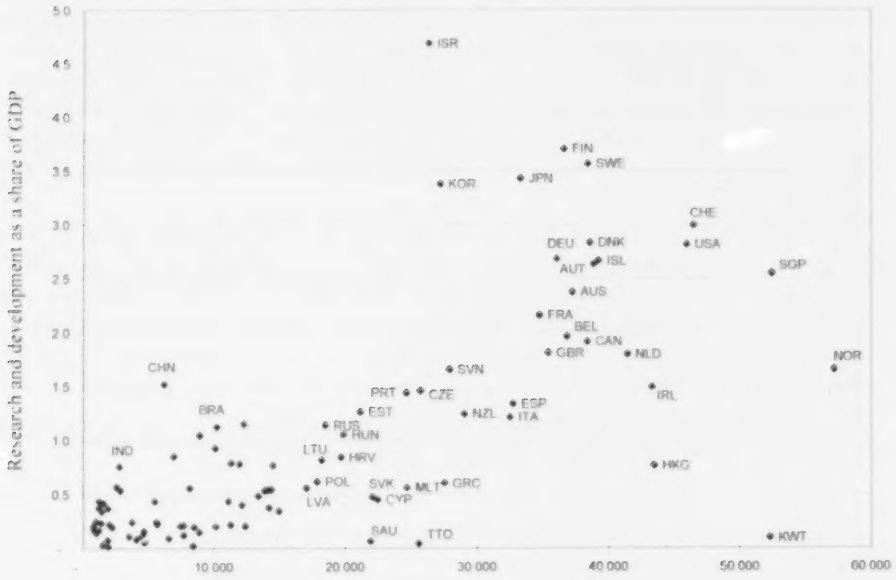
[3] See for example Francis Curry, Director General of the World Intellectual Property Organization (WIPO), "Towards a world of multipolar innovation", statement to the Seventh Ministerial Conference of the World Trade Organization, Geneva, 30 November 2009, available from www.wipo.int/about-wipo/en/dgo/speeches; or United Nations Development Programme (UNDP) and United Nations Framework Convention on Climate Change secretariat, *Handbook for Conducting Technology Needs Assessment for Climate Change* (New York, UNDP, 2010), annex 11.

compared with developed ones. Perhaps equally importantly, the research and development effort also varies significantly between countries of similar GDP per capita. Among low-income economies, the rate varies between nearly zero and 0.5 per cent. The range of variation is greater among middle-income economies, some of which have higher rates than some of the high-income economies. In particular, many smaller economies (in absolute terms) show low ratios of research and development against GDP. Against this background, peer-review-type monitoring might help Governments learn from best practice in comparable economies. Recent efforts to come up with broader measures of innovation capabilities, such as the Global Innovation Index, present a similar picture, in which some middle-income economies outperform certain high-income economies or are outperformed by some of the lower-income ones.[4]

13. It is not clear whether the absence of many countries from this picture represents the absence of evidence or evidence for weak research and development efforts. This underlines the importance of efforts (e.g. by the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics and others) to complete the coverage and international comparability of data on innovation inputs.

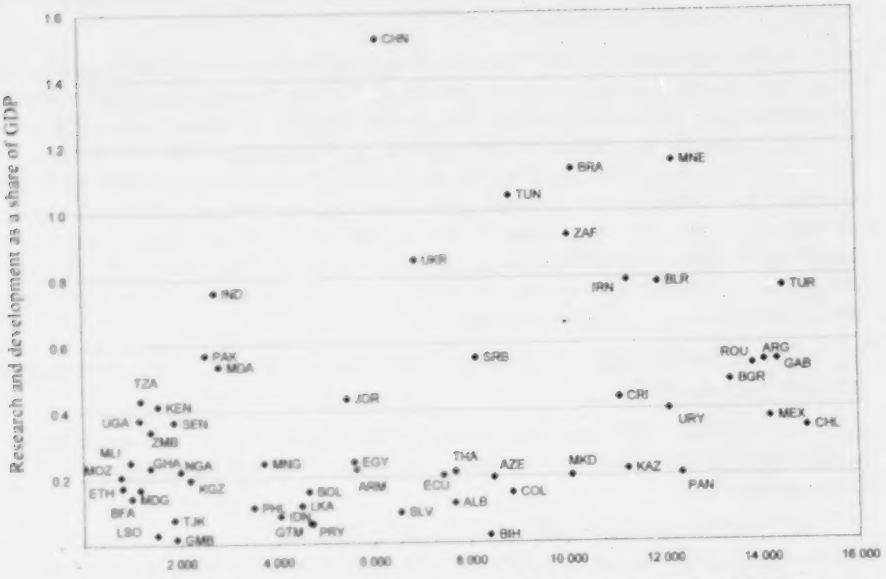
Figure II
Research and development intensity, average for 2007-2009

Global snapshot



[4] Sumitra Dutta and Bruno Lanvin, eds., *The Global Innovation Index 2013: The Local Dynamics of Innovation* (Geneva, Ithaca, New York, and Fontainebleau, France, Cornell University, INSEAD and WIPO, 2013), table 2.

Economies with gross domestic product per capita below $15,000 at purchasing power parity



GDP per capita based on purchasing power parity (current international dollars)

Source: UNESCO Institute for Statistics online database (accessed July 2013).

Note: Economies with GDP per capita below $15,000 at purchasing power parity are shown separately, as this maximizes visual clarity.

Abbreviations: ALB, Albania; ARG, Argentina; ARM, Armenia; AUS, Australia; AUT, Austria; AZE, Azerbaijan; BEL, Belgium; BFA, Burkina Faso; BGR, Bulgaria; BIH, Bosnia and Herzegovina; BLR, Belarus; BOL, Bolivia (Plurinational State of); BRA, Brazil; CAN, Canada; CHE, Switzerland; CHL, Chile; CHN, China; COL, Colombia; CRI, Costa Rica; CYP, Cyprus; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ECU, Ecuador; EGY, Egypt; ESP, Spain; EST, Estonia; ETH, Ethiopia; FIN, Finland; FRA, France; GAB, Gabon; GBR, United Kingdom of Great Britain and Northern Ireland; GHA, Ghana; GMB, Gambia; GRC, Greece; GTM, Guatemala; HKG, Hong Kong, China; HRV, Croatia; HUN, Hungary; IDN, Indonesia; IND, India; IRL, Ireland; IRN, Iran (Islamic Republic of); ISL, Iceland; ISR, Israel; ITA, Italy; JPN, Japan; JOR, Jordan; KAZ, Kazakhstan; KEN, Kenya; KGZ, Kyrgyzstan; KOR, Republic of Korea; KWT, Kuwait; LKA, Sri Lanka; LSO, Lesotho; LTU, Lithuania; LVA, Latvia; MDA, Republic of Moldova; MDG, Madagascar; MEX, Mexico; MKD, the former Yugoslav Republic of Macedonia; MLI, Mali; MLT, Malta; MNE, Montenegro; MNG, Mongolia; MOZ, Mozambique; NGA, Nigeria; NLD, Netherlands; NOR, Norway; NZL, New Zealand; PAK, Pakistan; PAN, Panama; PHL, Philippines; POL, Poland; PRT, Portugal; PRY, Paraguay; ROU, Romania; RUS, Russian Federation; SAU, Saudi Arabia; SEN, Senegal; SGP, Singapore; SLV, El Salvador; SRB, Serbia; SVN, Slovenia; SWE, Sweden; THA, Thailand; TJK, Tajikistan; TTO, Trinidad and Tobago; TUN, Tunisia; TUR, Turkey; TZA, United Republic of Tanzania; UGA, Uganda; UKR, Ukraine; URY, Uruguay; USA, United States of America; ZAF, South Africa; ZMB, Zambia.

2. How do needs and options differ among developing countries?

14. Technology needs should be surveyed at the country level. It is generally accepted that both technology needs and capabilities differ among developing countries. Certain technologies may be better suited for some countries than for

others, given resource endowments, existing technological capabilities and other factors. In addition, officials and experts from a wide range of countries underline the importance of technologies being made available at a scale commensurate with sustainable development challenges.

15. Technology needs assessment has been established as a method to survey the scope and composition of a country's needs with a view to identifying and selecting environmentally sound technologies that are appropriate.[5] In order to provide support for such assessments and policy instruments in developing countries, to date the United Nations Environment Programme (UNEP) Collaborating Centre in Risoe, Denmark, has carried out 31 national technology needs assessment reports. The results of national reports are being used in the preparation of national climate strategies, including adaptation or mitigation targets and regulatory frameworks for domestic renewable energy technology manufacturing.[6] For a comprehensive assessment of needs, the following might be considered:

(a) Ensuring that all countries that could benefit from international cooperation are covered;

(b) Similar efforts to assess needs for clean technologies that are related to sustainability goals other than climate issues (e.g. waste management, agriculture, biodiversity, etc.);

(c) While national technology needs assessment reports are meant to be context-dependent and country-specific, it would also be valuable to build on the work of the United Nations Framework Convention on Climate Change secretariat in synthesizing their findings and come up with a picture of the scope and magnitude of global needs.

16. Technology needs and options can be identified more easily when an overall framework exists to help policymakers understand what mix of technology imports (including transfer), adaptation and local technology generation is appropriate for local circumstances. Table 2 is an example of a framework to establish a differentiation of focus on the basis of both the level of development and country size, proposed in the context of Climate Innovation Centres. While this represents only one perspective that narrowly focuses on climate goals, a similar framework might be useful to support the international deliberations on systemic answers to developing countries' technology needs.

[5] National technology needs assessment reports, as well as an analysis and synthesis of their findings, are available from http://unfccc.int/ttclear/templates/render_cms_page?TNA_home.

[6] See the presentation by Jorge Rogat (UNEP Collaborating Centre at Risoe) for national examples.

Table 2
Proposed framework to differentiate technology facilitation according to country size and level of development

	Large-/medium-population countries		*Low-population countries*	
	High GDP	*Medium/low GDP*	*High/medium HDI*	*Low HDI*
Scale of Climate Innovation Centre	National	National	Regional	Regional
Scope of Climate Innovation Centre	Main technology thrust	Technologies for basic energy needs; mitigation; adaptation	Mitigation; adaptation	Technologies for basic energy needs; adaptation
	Innovation process	Full range (technology research, development/ modification and deployment)	Emphasis on deployment process and strategies	Emphasis on deployment process and strategies
Need for international resources (financial, human resources)	Selective	High	Selective	High

Source: Ambuj Sagar and Bloomberg New Energy Finance, *Climate Innovation Centres*.
Abbreviation: HDI, human development index.

3. How can technology policy help to eradicate poverty?

17. Discussions on technology transfer are dominated by a focus on renewable energy and sustainable transport in the context of addressing global climate change concerns. This needs to be complemented by greater attention to clean and environmentally sound technologies in other sectoral activities that are relevant for development and poverty eradication. Agriculture is one of these, as it plays a key role in poverty eradication and necessitates an integrated look at many issues in which technology solutions are relevant, including water, land use and biotechnology.

18. Development and poverty eradication tend to be the immediate and highest priority of policymakers in developing countries. In order to foster the development and dissemination of technologies relevant for agriculture and poverty eradication in general, there is a need to reconcile a number of different perspectives:

(a) The view advanced by some analysts and policymakers, particularly in Asia, that many of the clean and environmentally sound technologies needed by developing countries "are not there" and thus there is a need for a government-driven, "big-push" effort similar to the Green Revolution in the 1970s;

(b) The view that much of the effort to develop transformative technologies that can decouple growth from environmental degradation needs to take place in the leading developed countries;

(c) Calls for a fundamental paradigm shift in the predominant agrifood system with institutional change, capacity development and investment in order to move towards a sustainable production system and consumption patterns and agriculture that is multifunctional and addresses the resilience needs of small-scale and family farmers;[7]

(d) The view advanced by some civil society organizations and others that people no longer live in the technocratic policy world of the 1970s and that greater attention ought to be paid to technology assessment and technology solutions developed through the direct participation and consultation of social movements and local communities.[8]

19. These perspectives are not necessarily irreconcilable. However, any United Nations system-wide effort to accelerate technology development and diffusion in agriculture and other sectors with a direct bearing on poverty needs to articulate how they can be made to work in synergy.

4. Is the world close to critical mass for a global big push for renewable energy?

20. Renewable energy is where much of the action is regarding clean and environmentally sound technologies, from their invention to international efforts on dissemination, and yet it is also the area where the sense of urgency and the risk of "too little, too late" is most acutely felt.

21. Developing countries need to have adequate and affordable supplies of energy in order to meet developmental challenges, since energy services are closely interlinked with social, human and economic development. The challenge of energy access is particularly critical: more than 1.6 billion people are without electricity, and 2.6 billion depend on traditional biomass for their household cooking needs.[9] Providing modern forms of energy — electricity and clean cooking energy — to the energy poor is an urgent need.

22. At the same time, the gap between what needs to be done to avoid a 2°C temperature rise and what has been pledged in recent sessions of the Conference of the Parties to the United Nations Framework Convention on Climate Change needs to be closed.

23. A global collective action programme in the area of sustainable energy could be within reach. For example, efforts inspired by the Sustainable Energy for All initiative support a framework for establishing, monitoring and helping national efforts that could, under the right circumstances, double the share of modern renewable energy against global energy consumption by 2030 (fig. III).

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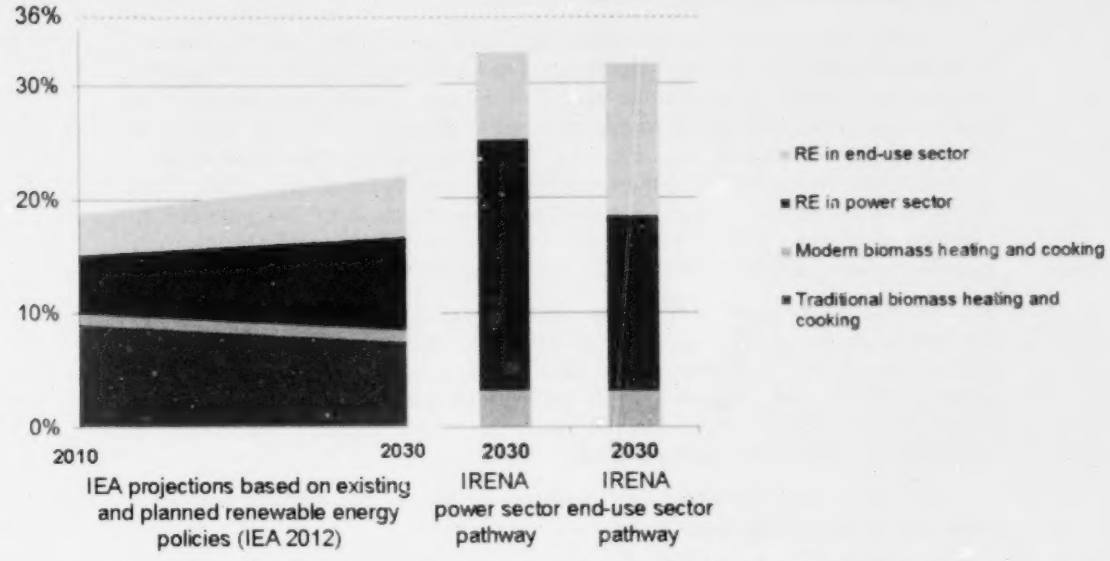
[7] Presentation by Hans R. Herren, President of the Millennium Institute.

[8] Presentation by Neth Daño, Action Group on Erosion, Technology and Concentration.

[9] Presentation by the Chief of the Policy Development and Coordination, Monitoring and Reporting Service of the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States.

Figure III
Global renewable energy projections, International Renewable Energy Agency



Source: Presentation by Imran H. Ahmad, Senior Programme Officer (Regions), International Renewable Energy Agency; and International Renewable Energy Agency, "A path to doubling global renewable energy (REMAP 2030)", policy brief, 2013.
Abbreviations: IEA, International Energy Agency; IRENA, International Renewable Energy Agency, RE, renewable energy.

24. However, in order to elevate the international cooperation efforts in renewable energy into a decisive global action programme, there is a need to bring about a shared understanding of key problems and options to address them, including the following:

(a) In renewable energy, some commentators support the view that "the technology is there" and that, at the international level, the key issue is deployment. At the same time, others argue that there are few technologies for adaptation and most of them are focused on major developing countries. This reveals a need to clarify and quantify the balance of international action needed to foster further science and research in this area;

(b) It is often observed that capabilities are found in countries that are already doing well. Need is highest in the least developed countries;

(c) There is a need to address the current artificial divide in the world between climate mitigation and energy access. International assistance is currently focusing on polluters but should instead concentrate resources on non-polluters/low emitters and foster their access to clean energy;

(d) There are conflicting perceptions regarding the benefits of the growing share of a few major emerging economies in the production and export of key renewable energy technologies, such as wind turbines or photovoltaic cells, at competitive cost. International dialogue in this area could help disentangle mercantilist objectives from global sustainability objectives.

B. Capacity-building

1. Is it fragmentation or necessary decentralization?

25. A large number of capacity-building activities are on offer or in development in the area of clean and environmentally sound technology facilitation at the bilateral, regional and global levels. Further activities are being continually proposed by international organizations and partnerships, some of which have been included in the proposals submitted in response to a request for input by the Department of Economic and Social Affairs of the Secretariat in May 2013 and are available from the workshops' website. Figure 3 contained in document A/67/348 provided an overview of United Nations contributions and partnerships, many of which include capacity-building activities along the different stages of the technology cycle.

26. Despite the large number of capacity-building activities on technology, the question arises as to whether these activities are commensurate with the need. Discussions at the workshops have highlighted a perceived fragmentation of capacity-building and, in general, of all international technology facilitation efforts in this area. In order to progress in addressing this fragmentation, it is necessary to understand to what extent the fragmentation implies that:

(a) There are significant gaps with regard to capacity-building and other international cooperation needs that are not served; and/or

(b) There are important overlaps or insufficient coordination between existing bodies; or, alternatively

(c) There is simply a large array of challenges and responses to them, with a diverse set of organizations offering capacity development within an open system for experimentation and specialization.

27. The presentations and discussions at the workshops have lent support to the view that, with the exception of the work of UNESCO, most capacity-building relates to the later stages of the technology cycle, notably diffusion, while there is relatively little emphasis on strengthening the capabilities of developing countries to undertake earlier-stage activities, such as research and development. This is a serious issue, as one of the major constraints in most developing countries is the shortage of basic science and research capabilities. Even when a given technology can be transferred on preferential terms to a developing country, benefiting fully from it in a sustained manner usually depends on indigenous technological capabilities and the availability of numerous ancillary skills and management capabilities across the economy.

28. At the same time, those who believe that stronger coordination is necessary need to elaborate how the global coordination and oversight of existing bodies and initiatives can preserve the ability of individual countries to select international assistance programmes most appropriate to their needs. Those who favour the present decentralized or fragmented panorama need to explain how this can ensure rational outcomes that are commensurate with the needs, given that the set-up and maintenance of initiatives are not necessarily driven by the countries most in need.

29. Improvements to international capacity-building activities could include some of the following:

(a) Information clearing house-type activities that help countries to navigate the complex geography of institutions providing technology facilitation services internationally;

(b) Fostering, broadening and generalizing new international initiatives that help connect existing "fragments" through collaborative partnerships between them. The workshops highlighted examples, such as the Climate Technology Centre and Network, which brings together research, academic, national and international institutions and think tanks (see fig. IV);

(c) Developing the capability to map out and quantify the international capacity-building support needed and the ability to monitor the extent to which this need is being served.

Figure IV
Climate Technology Centre and Network consortium

Source: Presentation by Morgan Bazilian, National Renewable Energy Laboratory.
Abbreviations: CATIE, Tropical Agricultural Research and Higher Education Centre; CSIR, Council for Scientific and Industrial Research; ECN, Energy Research Centre of the Netherlands; ENDA, Environment and Development Action in the Third World; GIZ, Deutsche Gesellschaft für Internationale Zusammenarbeit; ICRAF, World Agroforestry Centre; NREL, National Renewable Energy Laboratory; TERI, The Energy and Resources Institute; UNIDO, United Nations Industrial Development Organization.

2. What can South-South and triangular cooperation contribute?

30. North-South cooperation in the area of technology facilitation enjoys one clear advantage. As a result of international commitments, for example in relation to article 4, paragraph 5, of the United Nations Framework Convention on Climate Change, countries have an incentive to report their activities as part of their obligation to promote, facilitate and finance, as appropriate, the transfer of or access to environmentally sound technologies and know-how to other Parties, particularly developing country Parties.[10] More generally, official development assistance (ODA) from developed to developing countries for environmental and other sustainability objectives is reported within an internationally comparable and verifiable

[10] See for example http://unfccc.int/ttclear/pages/bilateral_support.html.

framework.[11] However, there is no global framework for monitoring development cooperation activities between developing countries or triangular ones, and knowledge on these is anecdotal.

31. Bilateral cooperation between larger economies is a key element of international facilitation in the area of clean and environmentally sound technologies. Along with North-South initiatives (e.g. the United States-China Clean Energy Forum, the United States-India Partnership to Advance Clean Energy, European Union-India solar energy cooperation, the Green Future Action Corps of Japan and the newly established United States-China Working Group on Climate Change), important cooperation programmes exist between major emerging economies (e.g. the China-India Climate Change Cooperation Accord and the India-Brazil-South Africa Dialogue Forum, the latter focusing on energy and medical technologies). Cooperation between Brazil and Mozambique in the area of antiretroviral medicine is a notable example of South-South cooperation with an impact on a least developed country (see box 1), which highlights the technological potential in the more advanced developing economies that could contribute to enhancing technology facilitation.

Box 1

Fundação Oswaldo Cruz, Ministry of Health, Brazil

Key features of the country's technology cooperation with Mozambique in the area of antiretroviral medicine include:

- The sheer scale of experience and capability that Brazil can leverage in the case of Fundação Oswaldo Cruz, which was founded in 1900 under the Ministry of Health and currently has 22 scientific and technological institutes, 12,000 staff (including 900 PhDs), a budget of more than US$ 1 billion and 1,800 projects generating more than 1,000 scientific papers each year.
- The sheer scale of the challenge in Mozambique: 18 per cent of the population has HIV/AIDS, with treatment reaching less than 40 per cent of adults and 25 per cent of children who are infected; 80 per cent depend on medicines supplied through foreign donations.
- Creation of a public enterprise in Mozambique for the sustainable production of antiretroviral and other medicines, including human resources training, technology transfer and technical assistance in good manufacturing and management practices and international certification, among others.
- Assistance in strengthening the local regulatory agency and aligning other health policies.
- Joint financing by Brazil (public and private funds) and Mozambique.

Source: Presentation by Lícia de Oliveira, Fundação Oswaldo Cruz.

[11] See www.oecd.org/dac/environment-development/statisticsonenvironmentalaid.htm. This does not mean that there are no issues with respect to the classification of specific ODA flows as contributing to sustainability.

32. The following could help to better understand and foster the contribution of cooperation among countries both within and across development stages:

(a) Building international dialogue to foster complementarities between North-South and South-South initiatives and ensuring that there are no major gaps left in cooperation activities;

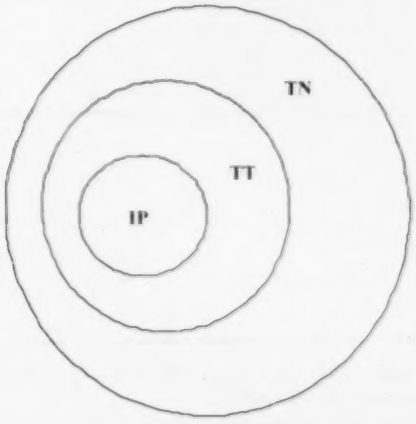
(b) Identifying new opportunities for triangular or multi-sided cooperation that would combine the relative strengths of multiple cooperation partners, no matter their level of development, in addressing critical sustainability technology needs;

(c) Extending and/or strengthening international frameworks for monitoring and tracking international assistance for sustainable development and technology facilitation to include improved measurement and accounting for technology transfer and to cover activities by developing countries in an internationally comparable manner.

3. How should intellectual property issues be addressed in the context of technology facilitation?

33. The role of intellectual property with respect to technology facilitation remains controversial. Figure V depicts a proposal on how to consider this issue. Previous discussion in the present report and the workshops underpinning it suggest that technology transfer as such represents only a part of the bigger problem of nurturing developing countries' capacity to develop or absorb and utilize imported clean technologies in a durable manner. In turn, intellectual property protection is only one of many factors that affect technology transfer.

Figure V
Relative importance of intellectual property protection



Unknowns/disagreements: TT/TN = ? IP/TT = ? → IP/TN = ??

Note: The relative sizes of spheres in the representation are purely arbitrary.
Abbreviations: TN, technology needs of developing countries; TT, technology needs of developing countries that require technology transfer; IP, technology transfer needs where intellectual property protection is a significant constraint.

34. The workshops echoed the inconclusive discussion on the role of intellectual property protection, with some panellists emphasizing its facilitative role and others pointing to ways in which it can pose a barrier to technology transfer. They shed light on the complexity of the issue and the need to consider intellectual property on a case-by-case basis, since its importance either as a facilitator or as a barrier varies greatly, depending on the industry and the technology. In addition, intellectual property systems vary greatly across countries, as they have considerable discretion in designing systems that they find best suited to their development.[12]

35. A key concern behind calls for further international action is the observation that intellectual property ownership is highly concentrated. While clean technology patenting has increased by 20 per cent each year since Kyoto, 80 per cent of clean energy patents are owned by entities in six countries (Japan, United States of America, Germany, Republic of Korea, United Kingdom of Great Britain and Northern Ireland and France), according to a survey conducted by the International Centre for Trade and Sustainable Development.[13] The licensing of clean technology to developing countries is also concentrated in big emerging economies. The survey suggests that the majority of technology owners never license clean technologies to developing countries. More importantly, the survey adds support to the view that intellectual property protection is one among a number of important factors (scientific capabilities, investment climate, etc.) affecting the propensity to license technology or enter into cooperation with a developing country (table 3).

Table 3

Factors affecting licensing or cooperation with developing countries

(Percentage of respondents)

"When your organization is making a decision whether or not to enter into a licensing or cooperative development agreement with a party in a developing country, to what extent would the following factors positively affect your assessment?"

	Protection of intellectual property rights	*Scientific capabilities and infrastructure*	*Favourable market conditions*	*Favourable investment climate*
Not a factor	18	13	16	15
A basic precondition for doing business but not a driving factor	28	37	26	27
Significantly attractive condition, would encourage negotiation	29	37	44	42
Compelling reason towards an agreement	25	13	14	16

Source: UNEP, European Patent Office and International Centre for Trade and Sustainable Development, *Patents and Clean Energy*.

Note: Sample size of 160 organizations, two thirds of which are private companies.

[12] WIPO has undertaken active capacity-building efforts to support the development of suitable national intellectual property regimes. Examples include technology and innovation support centres (www.wipo.int/tisc/en) and technical assistance activities (www.wipo.int/global_ip/en/activities/technicalassistance).

[13] UNEP, European Patent Office and International Centre for Trade and Sustainable Development, *Patents and Clean Energy: Bridging the Gap between Evidence and Policy* (2010).

36. Beyond transborder flows of technology and knowledge, a cursory look at the recent evolution of intellectual property filings worldwide appears to confirm the picture of concentration (table 4), with developing countries other than China representing a small and, in some respects, declining share of global totals. However, these numbers have to be handled with great care, as not every patent, trademark or design is of equal value and, as previously stated, their importance varies by sector. Thus, individual countries' different economic specializations are bound to generate some differences in intellectual property registration propensities. It is also important to bear in mind that those developing countries that have made significant progress in strengthening intellectual property protection domestically may be seeing faster growth in intellectual property filings in their offices, accounting for lower global shares in countries that have not done so.

Table 4
Intellectual property filings by office and income group

	Share of world total (percentage)						
	Patents		*Trademarks (class count)*		*Designs (design count)*		*GDP at market prices*
Office and income group	*2008*	*2011*	*2008*	*2011*	*2008*	*2011*	*2011*
High-income countries	74.8	67.0	52.8	45.1	44.9	37.2	68.2
China	15.1	24.6	12.8	22.8	43.6	53.1	10.0
Other upper-middle-income countries	7.1	5.2	22.7	21.1	8.4	6.4	14.6
Lower-middle-income countries	3.0	3.2	10.4	9.9	2.8	3.1	6.8
Low-income countries	0.1	0.0	1.3	1.0	0.3	0.2	0.7
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Adapted from the World Intellectual Property Organization (WIPO) statistics database, October 2012, cited in WIPO, *World Intellectual Property Indicators 2012* (Geneva, 2012). GDP shares calculated from world development indicators, available from http://data.worldbank.org.

37. Despite these caveats, it is worth noting that China accounts for the most significant increase in the use of codified and protected knowledge offered by the intellectual property protection system. In addition, the better-known examples of bilateral or multilateral technology cooperation agreements (European Union-India, United States-China, United States-India, China-India, India-Brazil-South Africa) do address intellectual property issues by including specific provisions on the ownership of intellectual property arising from them.

38. There is a need to generate a greater sense of shared diagnosis and shared objectives on a number of key questions in relation to intellectual property protection, especially in relation to clean and environmentally sound technologies:

(a) There is a need to better understand patenting landscapes for clean and environmentally sound technologies in developing countries and, in particular, identify concrete cases where intellectual property rights do pose an obstacle towards technology transfer;

(b) There is a need to better understand the role of non-patented know-how for clean and environmentally sound technologies and how such know-how is best transferred;

(c) Concerns about the use of intellectual property for reasons other than protecting genuine inventions or innovations include whether worries about the strategic use of patenting and the proliferation of patents and questions about their quality are justified; whether the existing information repositories (e.g. PatentScope, WIPO) or capacity-building efforts by international organizations and norm-setting activities to improve the quality of patenting are sufficient; and what more can be done and where it should be done;

(d) Fast-tracking of clean technology patents: whether this option is promising enough to be pursued more widely and what lessons emerge from its practice in a number of countries;

(e) Granting flexibilities to the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement) in the form of compulsory licensing or exhaustion for clean and environmentally sound technologies on grounds (recognized by the Doha Declaration on the TRIPS Agreement and Public Health of 2001 with respect to essential medicines) that these represent a matter of national emergency. However, some strongly doubt that following the example of the case of essential medicines is relevant in this case, in view of the vast range of clean and environmentally sound technologies;

(f) Whether stronger intellectual property protection by developing countries helps or hinders their capacity to generate or receive transfers of clean and environmentally sound technologies: some studies indicate that an effective intellectual property system may be a prerequisite for companies to enter into technology transfer agreements. However, the incidence of intellectual property varies by sector, and it is recognized that little is known of climate adaptation technologies, beyond the experience of China and India, in this regard. All this warrants a focus on generating more comprehensive empirical evidence on this question;

(g) Whether there is convincing evidence of the potential of new approaches to intellectual property management, such as "socially responsible licensing",[14] patent pools and funding for key patent acquisition, to offer pragmatic solutions and the potential for scaling them up to be able to offer significant solutions to technology gaps in developing countries;

(h) There is also a need to explore what possibilities would be offered by granting preferential access to patents arising from publicly financed research. In renewable energy, more than half of global research and development spending was publicly financed in recent years, owing partly to green stimulus in several large economies.[15]

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[14] See for example University of California Berkeley, Office of Intellectual Property and Industry Research Alliances, "Socially responsible licensing and IP management". Available from http://ipira.berkeley.edu/socially-responsible-licensing-ip-management.

[15] UNEP and Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2012* (Frankfurt, Frankfurt School of Finance and Management, 2012).

39. The special conditions of least developed countries regarding intellectual property protection in the context of clean and environmentally sound technologies are recognized in international commitments. However, a possible contradiction has been noted between article 66, paragraph 2, of the TRIPS Agreement, which commits developed countries to promoting technology transfer to least developed countries, and article 66, paragraph 1, which exempts least developed countries from the obligation to provide national treatment and most-favoured-nation treatment in the area of intellectual property, which may be operating as a disincentive to technology transfer.[16]

40. There is an ongoing effort to design an international partnership that can address the needs of least developed countries in relation to intellectual property protection and broader technology facilitation issues through a proposal to create a technology bank for least developed countries (see box 2). Institutional and policy innovation in this area is welcomed by the least developed countries.[17]

Box 2
Technology bank for the least developed countries

In follow-up to the commitments made in the Istanbul Declaration and the Istanbul Programme of Action, adopted at the Fourth United Nations Conference on Least Developed Countries, held in 2011, and pursuant to resolution 67/220, the report of the Secretary-General on a technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries (A/68/217) proposed a technology bank with the following components:

(a) A patents bank to help least developed countries obtain access to and utilize appropriate technologies, including:

(i) A licensing facility to help least developed countries secure relevant intellectual property at negotiated or concessionary rates;

(ii) Technical assistance in identifying appropriate technologies;

(iii) An enforcement mechanism ensuring the use of such intellectual property in least developed countries only, as well as an arbitration mechanism;

(iv) Assistance in protecting intellectual property rights derived by inventors from least developed countries;

(b) A science, technology and innovation supporting mechanism to help improve least developed countries' scientific research and innovation base, including:

(i) Support to building least developed countries' endogenous human and institutional capacity for acquisition and adaptation technologies;

[16] Presentation by George Dragnich, Consultant, Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States.

[17] Statement made by Bangladesh on behalf of least developed countries at the workshops.

(ii) Assistance with the establishment of technology incubators in universities in least developed countries and support for information and communications technology connectivity, especially at the campus "last mile";

(iii) Support with marketing least developed countries' research results and improving intellectual property rights management capability;

(iv) Leveraging least developed countries' diaspora knowledge networks;

(c) A science and technology research depository facility to promote global networking of researchers and research institutions in least developed countries, including:

(i) Support for least developed countries in obtaining access to scientific literature by building on the existing Research4Life initiative, a United Nations public-private partnership;

(ii) Assistance with brokering least developed countries' research collaboration through partnerships with advanced-economy and developing world institutions, as well as triangular cooperation;

(iii) Research support and networking services for researchers from least developed countries;

(iv) Capacity-building support in order to expand the publication of scientific work in least developed countries in peer-reviewed journals.

In the context of the technology bank for the least developed countries, Heads of State and Government welcomed, in the Istanbul Declaration, the generous offer of the Government of Turkey to host an international science, technology and innovation centre. Strong global support involving all the development partners, as well as countries from the South, will be central to its effectiveness. The report of the Secretary-General proposes further consultations, to be serviced by the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, to work out the institutional details of the technology bank.

III. Options for a way forward

41. The review above reveals that: (a) technology needs have not been mapped systematically; and (b) views vary significantly as to whether the international programmes and mechanisms to assist in terms of capacity-building correspond to the needs. In any event, in the absence of a shared understanding of needs, it would have been surprising to see agreement on whether there is sufficient international support at hand to meet them. Bearing this in mind, the following paragraphs represent an effort to identify those recommendations around which agreement for collective action could be built.

42. On the basis of discussions at the workshops and written contributions by Member States and United Nations system organizations, three groups of recommendations are presented. The first consists of initiatives that can be acted on without institutional reform. The second includes actions that individual countries or groups of countries could add to the former on a voluntary basis. The third category presents a set of more comprehensive and ambitious initiatives that have been proposed by participants but are not universally accepted. If momentum for collective action could be generated around the first and perhaps the second set of recommendations, options in the third category could be reappraised in due course.

43. This approach is encouraged by one key finding: throughout the discussions at the United Nations on this subject, no one questioned that accelerating technology facilitation (i.e. dissemination of technologies across national frontiers and economic development levels) is a shared objective of all Member States, international organizations and other stakeholders or that international cooperation in this area should be fostered.

44. However, different views were expressed on the details and the overall approach for the way forward. To move beyond the current stalemate in the debate on whether a global facilitation mechanism is essential, it is important to generate more hard data and evidence on what exactly is needed and how best to achieve it.

45. If a meeting of minds is to occur, those who currently oppose further initiatives need to be reassured that the purpose of the exercise is not the generation of mandatory technology transfer requirements. On the other hand, those who want a global technology facilitation mechanism need to be reassured that the purpose of further discussions is not to "kick the can down the road".

A. Initiatives that can be acted on without institutional reform

Recommendation 1
Conduct broad, methodical and periodic examinations of needs, gaps and achievements in the development, transfer and dissemination of clean and environmentally sound technologies.

46. Ad hoc workshops can enrich international dialogue, but they alone cannot provide a process towards the tangible convergence of views. What is needed is an intergovernmental "locus" with the participation of relevant stakeholders and backed by professional expertise, to monitor how needs and efforts to address them are evolving. Thus, it is proposed that intergovernmental discussions be held periodically — within an existing framework, such as the United Nations high-level political forum for sustainable development — on global reports on developing countries' technology needs, prepared by the Secretariat as part of an agreed work programme and discussed in special sessions expanded to include outside experts, as well as specialists from relevant United Nations entities. A summary of findings might be included periodically in the envisaged global sustainable development report. Such deliberations could focus on some of the questions highlighted in section II of the present report and, along with other deliberations referred to in subsequent recommendations, would constitute one dimension of the overall work of the high-level political forum on sustainable development.

Recommendation 2

Strengthen the capacity to help all countries in converging to best practice in data availability regarding science, research and development and technology inputs and outcomes according to internationally comparable methodologies.

47. This would require building on existing efforts by the Statistics Division of the Department of Economic and Social Affairs, the UNESCO Institute for Statistics, WIPO, the Organization for Economic Cooperation and Development and others by tailoring technical assistance to address data availability, quality and timeliness gaps. It would also include support for methodological work to adequately track innovation inputs and outputs that are relevant for sustainable development and address the dearth of information on smaller and poorer developing economies. While the activity to be measured (research and development, patenting, etc.) may be relatively small in many countries, it will be important to reveal reliable information on the differentials among otherwise comparable economies. That in turn can help better target technology facilitation. In addition, a serious measurement effort can, in itself, have a positive impact on the propensity to allocate resources (including from official aid) to technological development. The high-level political forum could assist with this effort by providing a venue in which its results are given intergovernmental attention.

Recommendation 3

Build/foster a global reporting system covering all multilateral and bilateral capacity-building activities, as well as demonstration and pilot projects on clean and environmentally sound technologies.

48. This should encompass improved methodologies and indicators for measurement of international technology cooperation and technology transfer. One possible benefit would be the facilitation of the measurement of progress and accountability in the context of a post-2015 development agenda centred on poverty eradication and other sustainable development goals.

49. The system could build on the creditor reporting system on ODA and could be developed in synergy with it. Ideally, it would combine reporting by all countries of all inflows and outflows of technology-related assistance. It would build on and systematize ad hoc efforts, such as those tracking voluntary commitments and partnerships from the United Nations Conference on Sustainable Development, with a higher degree of granularity on assistance relating to clean and environmentally sound technologies than can be found in traditional aid statistics. It would also develop ways to make qualitative information on capacity-building activities available. It would strive to address the current dearth of information outside the renewable energy sector and would be based on global surveys intended to map the reach of capacity-building activities and the extent to which needs are effectively served.

Recommendation 4

Mobilize United Nations support for the agreed technology bank for least developed countries.

50. As indicated above, the United Nations system provides a wide range of capacity-building activities in the area of technology. A number of United Nations system organizations have been supporting the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island

Developing States in the work on the technology bank for least developed countries and should be encouraged to continue to do so. In view of those countries' capacity constraints, it would be important to mobilize expertise and capacity-building resources in all relevant United Nations system entities in order to support least developed countries in making full use of the agreed technology bank.

Recommendation 5
Facilitate intergovernmental dialogue on the transfer of publicly owned or funded technologies.

51. This could be initiated by an expert study on existing means, gaps and additional options with regard to the transfer of publicly owned or funded technologies to be discussed by an ad hoc voluntary group of countries with a view to reporting options for action by the high-level political forum. If it so decides, the group could constitute an informal "friends of international technology cooperation" group to advance intergovernmental dialogue on how to strengthen technology facilitation.

B. Additional, voluntary actions for consideration by countries

Recommendation 6
Promote voluntary national peer reviews of clean and environmentally sound technology needs, as well as options and outcomes in addressing them.

52. The reviews would be conducted within a framework that reconciles individual tailoring and learning from peers in similar situations. They could be discussed at special sessions under the aegis of the high-level political forum, possibly as part of the forum's assumption of the responsibilities of the annual ministerial review. They would need to build on and be coordinated with ongoing sector-specific country review processes (e.g. technology needs assessment in renewable energy) and would encompass all aspects of sustainable development. Development partners could also be invited to conduct voluntary reviews of their international cooperation activities in technology facilitation for sustainable development, in particular in support of developing countries' efforts to achieve sustainable development goals, once agreed.

Recommendation 7
Consider a sustainable development goal and/or targets in the area of technology.

53. A sustainable development goal in this area could be most useful if focused on removing barriers to and increasing competition for the development, dissemination and transfer of technological solutions relevant to sustainable development.

C. More comprehensive and ambitious initiatives with institutional implications

Recommendation 8
Create a forum within the United Nations (perhaps most appropriately under the auspices of the high-level political forum) for regular expert-informed intergovernmental dialogue on how best to facilitate and accelerate international technology cooperation for sustainable development, notably for the development, dissemination and transfer of clean and environmentally sound technologies.

Recommendation 9
Create a United Nations global technology facilitation mechanism.

54. Going beyond the provision of a forum for discussion, the high-level political forum could launch a mechanism involving the creation and/or scaling up of several initiatives, as proposed in paragraph 86 of the report of the Secretary-General on options for a facilitation mechanism that promotes the development, transfer and dissemination of clean and environmentally sound technologies (A/67/348), such as:

(a) A technology development and transfer fund to assist with the transfer of privately owned technologies relevant in responding to urgent global sustainability challenges;

(b) Global networks of national organizations relevant to different stages of the technology life cycle, such as science foundations, business incubators and intellectual property registration bodies;

(c) An international network of research/innovation policymakers that brings together representatives from technology leader countries, as well as developing countries, including least developed countries, to discuss options for promoting technology cooperation that can address sustainable development challenges faced by developing countries and, in particular, the poor and the vulnerable;

(d) Public-private-civil society partnerships designed to foster technology cooperation and the transfer of key technologies needed to advance progress towards specific sustainable development goals.

Recommendation 10
Develop a comprehensive and fact-based understanding of the role of intellectual property with respect to the development and transfer of clean and environmentally sound technologies and explore the basis for developing a special international intellectual property rights regime for a range of technologies relevant to sustainable development.